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ABSTRACT

This document presents the proceedings of a Congressional hearing on private sector initiatives to develop the National Information Infrastructure (NII) with a focus on understanding the nature of industry investment in the NII and how those investments will contribute to the Administration's goals for NII. Statements are provided by the following witnesses: Clark S. Ryan, Chief Technical Officer, AT&T Bell Laboratories; Ross K. Ireland, Vice President, Network Technology, Pacific Telesis Group; Stewart D. Personick, Assistant Vice President, Bellcore; and Peter P. Bassermann, Chairman, Technology and Operations Council, Cellular Telephone Industry Association and President, Southern New England Telephone Mobility. Discussion includes a hybrid fiber-optic network; the tension between open architecture and investment incentive in the initial development of an advanced NII; and technological challenges of interoperability. The following needs are identified: the reform of current federal policies, including removal of restrictions on private industry; federal support of standards and research and development of technology; maximizing social and economic benefits through an open competitive environment; consistency between industry technology deployment plans and the Administration's vision of NII; and affordable access. (AEF)

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TECHNOLOGY DEPLOYMENT AND INTEROPERABILITY IN THE NATIONAL INFORMATION INFRASTRUCTURE

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ED 381 131

HEARING

BEFORE THE

SUBCOMMITTEE ON
TECHNOLOGY, ENVIRONMENT AND AVIATION

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

JULY 26, 1994

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TECHNOLOGY DEPLOYMENT AND INTEROPERABILITY IN THE NATIONAL INFORMATION INFRASTRUCTURE

TUESDAY, JULY 26, 1994

HOUSE OF REPRESENTATIVES, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, SUBCOMMITTEE ON TECHNOLOGY, ENVIRONMENT AND AVIATION,

Washington, D.C.

The Subcommittee met, pursuant to call, at 1:35 p.m. in Room 2318, Rayburn House Office Building, Hon. Tim Valentine [Chairman of the Subcommittee] presiding.

Mr. VALENTINE. Ladies and gentlemen, we'll get started. This is a big day for us. Some things have occurred which weren't anticipated when this hearing was scheduled and when we began to organize it. So I hope and believe that we will be joined by other Members of the Subcommittee.

Today, the Subcommittee will review private sector initiatives to develop the National Information Infrastructure.

Our purpose today is to get a better understanding of the nature and extent of industry investment in the NII and to learn how those investments will contribute to the Administration's goals for NII.

Improving the Nation's information infrastructure is at the forefront of the Administration's agenda to promote economic growth and public welfare, not only in affluent areas but throughout the country.

The Administration's program to promote investment in the NII recognizes that private industry, in response to competition and advancements in technology, will build the future information infrastructure. It also recognizes that competition alone may not provide sufficient incentives for industry to make the investments that will be necessary to realize the full potential of the National Information Infrastructure.

In those cases where industry lacks the incentive to provide the necessary investments, the government has an obligation to act responsibly to ensure that the public interest is served.

Our goal in this effort is to make sure that those aspects of the Administration's NII initiative which are under our Committee's jurisdiction are properly scrutinized and, if appropriate, supported, directed and managed.

Here with us today to present the views of industry on these matters are Mr. Clarke Ryan, who is the Chief Executive Officer

at AT&T—Chief Technical Officer at—I'm not sure if that was a promotion or demotion—

Mr. RYAN. Thank you very much.

Mr. VALENTINE. —AT&T's Bell Laboratories in New Jersey; and Mr. Ross Ireland, who is Vice President for Network Technology at Pacific Telesis in California; Dr. Stewart Personick, who is Assistant Vice President at Bellcore in New Jersey; and Mr. Peter—excuse me, Peter Bassermann, who is Chairman of the Technology and Operations Council of the Cellular Telephone Industry Association and President of Southern New England Telephone Mobility.

I want to thank all of you for appearing here today for the time and effort that went into the preparation for you to appear here, and say to you that your statements will appear in the record as submitted to us. And if you would summarize, we would appreciate it.

Mr. VALENTINE. Mr. Ryan.

STATEMENTS OF CLARKE S. RYAN, CHIEF TECHNICAL OFFICER, AT&T BELL LABORATORIES, HOLMDEL, NJ; ROSS K. IRELAND, VICE PRESIDENT, NETWORK TECHNOLOGY, PACIFIC TELESIS GROUP, SAN FRANCISCO, CA; STEWART D. PERSONICK, ASSISTANT VICE PRESIDENT, BELLCORE, MORRISTOWN, NJ; AND PETER P. BASSERMANN, CHAIRMAN, TECHNOLOGY AND OPERATIONS COUNCIL, CELLULAR TELEPHONE INDUSTRY ASSOCIATION, WASHINGTON, DC., AND PRESIDENT, SOUTHERN NEW ENGLAND TELEPHONE MOBILITY, NEW HAVEN, CT

Mr. RYAN. Good afternoon, Mr. Chairman.

My name is Clarke Ryan. I am the Chief Technical Officer of the Transmission Systems portion of AT&T Bell Laboratories, and it's a pleasure to be here today on behalf of AT&T.

My comments on the subject are coming from the perspective of my technology responsibilities within the AT&T organizations, which is held to be responsible to invent and realize transmission and telecommunication communities.

Our efforts are continuously focused on bringing value to the marketplace and our customers, but the AT&T mission statement—and that is very simply that we are dedicated as a company to being the world's best at bring people together and giving them easy access to each other and to the information services they want and they need anytime and anyplace.

From the statement, the key concepts critical for the subject at hand today are the easy access portion and the anytime and anywhere. A key part of the AT&T strategy is to use our technology and our large-scale network experience to facilitate the society's rapid evolution towards a global electronic village. Our objective is highly synergistic with the objectives of the National Information Infrastructure.

We have a lot of experience both in the U.S. and abroad. And we've come to conclude that realizing such a vision requires us to bring together two widely disparate or separate realities. The one is the corporations and the Nation's in this case strategic objective to build the network, and the other is the millions and millions of local decisions made every day by the users of that network. And

by bringing these two overall together in a strategy, we are actively working to focus to make sure that progress is made rapidly and that the progress is pulled by the users of the network and their needs rather than pushed upon them by the industry or some standards which have not been tested.

Now, in that endeavor, the portion of the network that is most profoundly challenged is the access network. And by access network I refer to the part of the telecommunication network which connects the private business, small business or home to the closest telephone building or exchange. In reality, this connection tends to be a very small part of the physical link our signals travel, but it represents the most difficult to upgrade due to its massive size in terms of the numbers of customers it directly supports.

To solve that problem, we are currently active in two areas. One is—falls under the banner of fiber to the home, and in these efforts we bring fiber-optic cables directly to customer's homes. We've been doing this since the early 1980s on ongoing engineering and field work in the United States. We also have systems deployed in both Germany and in Japan.

In all these networks and these all fiber systems, we're constantly required to balance the desire for capability, for the capability of bringing service to the customer, against the cost of installing that capability. And although technology has done much to reduce the costs associated with optical components, there are still very real and practical mechanical issues which continue to make them incrementally more expensive than metallic solutions or cable solutions.

And this underlying issue is something we've dealt with for over 10 years now. We believe it will not disappear rapidly, and we are committed through both technical focus and excellence in our engineering laboratories to continue to make incremental progress to bring fiber closer and closer to the home as a reality.

Our second endeavor is in the hybrid fiber-coax arena, and we've really been working on that area since the mid-1980s. That originally came out of work we did within AT&T looking at research opportunities to use fiber-optic systems to carry analog signals.

Although multiple applications have arisen, this use of optical systems for analog transmission has become the building—basic building block for the cable TV backbone networks, and, in fact, today represents about half of the target application for the fiber-optic cable that AT&T produces.

In these networks, optical systems are installed to cover the larger distances in a network, and within a smaller neighborhood we convert to a metallic arrangement and distribute over normal coax as in a traditional plan. These result in a very cost-effective solution for even traditional cable TV networks, much higher quality and much higher reliability than a traditional metallic approach.

And in addition to carrying these analog video signals, we had noted for multiple years that they could be easily engineered to provide significant additional band width to carry services both analog and digital.

In our integrated hybrid fiber coax networks, we have married our digital radio technologies, our fiber coax technologies and our traditional telephone equipment. We take both digital, voice, data

and video signals, combine them with traditional cable TV signals, and distribute them throughout the network.

At or near a customer's location, equipment is installed to convert the signals to the appropriate format and interfaced to the customer's television set, telephone, computer or other appliance. This results in a network which enjoys all the flexibilities and benefits of a fiber-all network, growth potential and quality of a fiber-based system, and which, at the same time, avoids the economic penalties that had been traditionally associated with direct fiber to each individual's home.

We currently have in our hands the technologies required to make cost-effective, hybrid, fiber-coax systems. These networks will be able to provide access to literally hundreds of digital and analog video services and a full range of multimedia interactive services.

As we move forward, we are continuing to push the limits on the optical techniques, low-power electronics, distributed software network architectures, to enhance these systems towards higher levels of traffic, lower and lower costs, and perhaps most importantly, improved interfaces to human beings to make them easier to use, to install and to operate.

The underlying architecture of these networks allows us to implement an extremely extensible network which can support every high bit-rate data service conceivable today. And in our research laboratories our staff is investigating methods to extend this structure to take in the full asynchronous transport mode formats and also increase the band width through other cabling technologies.

The breakthrough potential of the National Information Infrastructure will bring with it unprecedented rates of change and surprise that even a roomful of chief technical officers like myself cannot fully predict. The network solutions such as hybrid fiber-coax are now enabling our customers to work with appliances, their customers and their networks to safely use their network to try services and to find out what the network truly needs and what the customer truly wants from the NII.

With the hybrid fiber-coax, we have developed a method of cost effectively bringing these capabilities into the public's hands, letting them educate us, experiment with them and teach us, the telecom industry members, what they need and how they would like to use the NII network.

So, in summary, I would like to make just three quick points. The hybrid fiber-coax has proven to be a very attractive, real, current and cost-effective network alternative that we can use to bring NII service to the marketplace today. Through the use of that network, we believe we can get very, very positive, real market data as to what the NII service mix should be and help our customers and our users to learn more from that.

And, finally, we very, very strongly support all actions to make sure interoperability and open interfaces are handled through these networks. Because, as I mentioned in my opening statement, the anytime, anywhere requires us to build equipment which will connect any customer to any service at anytime and anyplace. And it's critically important in a communications network that open interfaces to other services and providers be provided.

Thank you very much.

[The prepared statement of Mr. Ryan follows:]

ADVANCED TELECOMMUNICATIONS TECHNOLOGIES AND THE NII

STATEMENT OF

CLARKE S. RYAN

CHIEF TECHNICAL OFFICER - TRANSMISSION SYSTEMS

AT&T BELL LABORATORIES

ON BEHALF OF

AT&T

BEFORE THE SUBCOMMITTEE ON

TECHNOLOGY, ENVIRONMENT AND AVIATION

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

1:30 P.M.

2318 RAYBURN BUILDING

JULY 26, 1994

Good afternoon, Mr. Chairman. My name is Clarke Ryan. I am Chief Technical Officer, Transmission Systems, AT&T Bell Laboratories. I am pleased to be here today on behalf of AT&T.

My comments on this subject are driven from the perspective of my technology responsibility within the AT&T organization responsible for the invention and realization of transmission products. Our efforts are continuously focused on bringing value to the marketplace and our customers, as stated in AT&T's mission:

> *"We are dedicated to being the world's best at bringing people together, giving them easy access to each other and to the information services they want and need - anytime, anywhere."*

The critical concepts from this mission for the subject at hand are 'easy access' and 'anytime, anywhere'. A key part of the AT&T strategy is to use our technology and large scale network experience to facilitate society's rapid evolution toward a global electronic village. Our objective is highly synergistic with the objectives of the National Information Infrastructure. Our experience both in the United States and abroad has been that realizing such a vision requires bringing together widely separate realities: the strategic objective of building the network, on the one hand, and, on the other, millions of local decisions made by network users every day. By bringing the overall strategy and the local decisions together, we actively focus on making sure that progress is made rapidly and that the progress is pulled by the users rather than pushed upon them.

Communications networks whose target customers are the mass markets face a significant challenge. It is very easy, for example, to get trapped in the following circular argument:

- nearly all applications inherently require each individual to be able to reach a large number of other individuals;
- the economics suggest that a broad number of communications-based services should 'ride' the same fixed costs whenever possible (education, management, entertainment, traditional messaging, etc.);
- the scale of the investment for the physical network is very large;
- the scale of invention needed to build systems to offer services is very large;
- the marketing and education needed to bring customers to appreciate the opportunity is large; and
- without direction from the mass market, making the large investment to build what one thinks is needed is imprudent.

The portion of the network that is most profoundly impacted by this situation is the access network, which refers to the portion of the telecommunications infrastructure which connects the private business or residence to the closest exchange or 'telephone building'. Although this connection accounts for only a small part of the physical distance our signals travel, it represents the most difficult to upgrade for the following reasons:

- the significant amount of equipment and work associated on a per-customer basis;
- traditional planning assumptions that call for decisions with twenty-year horizons; and
- an approach to universal service which assumes that the type and quantity of service required by different customers in an area will be fairly uniform.

We have been working aggressively to identify network solutions which will allow us to provide access to a host of wide-band digital services for the small business and residential marketplaces. The boundary conditions of this effort include the following criteria:

- it must support all existing services and must be interoperable with existing network and customer equipment;
- it must provide operational savings to offset the required investments;
- it must be open to accommodate a growing service mix; and
- it must maximize opportunities for 'pay-as-you-go' installations.

From these efforts we have settled on three access offerings:

BUSINESS CARRIER ACCESS

For very high-end, large users, direct extension of the exchange building into the 'wiring closet' of the customer is extremely cost effective and flexible. This solution is suitable for multi-tenant office buildings. It is also potentially suitable for large multi-tenant living units, where there is a need for a large number of interactive digital or digitally derived services. In these applications, a fiber ring, together with the associated equipment traditionally used to tie telephone buildings together, is used to connect the customer's building to the network. From a network planners' perspective, the model

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customer's building to the network. From a network planners' perspective, the model takes advantage of the customer topology to assimilate a large number of individual service requests into a single managed order. The large fixed expense of extending the office can then be scheduled reliably for recovery.

FIBER TO THE HOME

Since the early 1980's, we have had ongoing engineering and field work under way, to bring fiber systems to the individual residence. Within the U.S., we have active programs to realize what are known as 'double star' networks. Basically, these systems implement a set of nested distribution systems, terminating on very small multiplex equipment located near one customer's home, but capable of serving multiple residences.

We have also engineered systems for the German and the Japanese PTTs to realize complete passive optical network (PON) systems. In these systems the identical composite signal is distributed to all homes on a fiber which the customer taps into by a box located at each customer site. Such a system realizes a true shared-medium architecture and is therefore attractive from a network flexibility perspective. These all-fiber systems require balancing the desire for capability against the cost of installation. Although technology has done much to reduce the costs associated with optical components, all such components need to maintain alignment and stability, measured in microns. In contrast, electrical connection systems allow orders of magnitude more tolerance for connectors, couplers and splices. This underlying mechanical distinction will not disappear rapidly and it requires both continued technical focus and time for continued incremental progress.

HYBRID FIBER-COAX

Since the mid 1980's, AT&T has been active in industrializing products that utilize optical systems for the transmission of analog signals. Although multiple applications have arisen, the use of optical systems for building the backbones of cable TV distribution systems has been the leading commercial interest, and, currently, nearly half of AT&T's annual production of fiber optical cable in the U.S. is used for such applications. In these networks, optical systems are installed to cover the large distances required in the distribution systems. Within a smaller neighborhood, the optical signal is converted to electrical and distributed via coax in a traditional manner. The result is a cost-effective solution for CATV networks with much higher quality and reliability than traditional approaches. In addition to carrying standard analog video signals, these systems can be readily engineered to provide for significant additional spectral bandwidth capabilities.

In our integrated hybrid fiber-coax networks, we have taken digital radio and modem technologies and married them into both our fiber-coax media and our traditional telephone interfacing equipment. Digital streams of 2Mb/s and higher are carried in spectrum within the fiber-coax bearer but outside the CATV spectrum. At the exchange office, these streams are inter-worked into standard interfaces for both switched and non-switched digital services. At or near the customer's location, multiplex equipment is installed to convert the signals to the appropriate format for the specific customer's equipment. The result is a network which enjoys all of the flexibility benefits of shared-media architecture, and the growth potential and quality of a fiber-based system, and, which, at the same time, avoids the economic penalties associated with direct fiber manipulation on a per-customer premise basis.

Our engineering analysis with our customers has demonstrated that we can install fiber-coax systems at a cost level which can be supported by near-term service demands, over a traditional, point-to-point, copper pair. When hybrid fiber-coax networks are engineered, decisions must be made as to the bit rate and density of services to be supported. These considerations determine how many customers can share the media at the coaxial, or electrical, portion of the network. The more sharing that the traffic can permit, the lower the initial costs of installation.

Because of the shared-media channel management structure used, the network allows later engineering to bring the fiber portion of the link closer to the customers, essentially splitting the coaxial portion into sub-networks in a manner similar to the way in which cell sites can be subdivided as traffic demands grow in wireless. Through careful planning, and at the customer's request, the required physical cable to allow such subsequent build-outs can be installed at the time of the initial construction. In this way, the extension to higher traffic rates can be done without major construction costs, and the first cost for the network remains low as well.

From a planning perspective, we currently have in hand the basic technologies required to make cost-effective, hybrid, fiber-coax networks. These networks will be able to provide access to broadband digital and analog distributed services, and to symmetric and asymmetric wideband digital services as well. As we move forward, we will continue to push the limits on optical connection techniques, low-power electronics, and distributed-network software approaches, to enhance the systems in the direction of higher traffic levels, lower costs, and improved man-machine interfacing (for the network operator and for the consumer).

The underlying architecture of hybrid fiber-coax allows us to implement an extremely extensible digital network, which can be evolved to provide very high bit-rate digital services. In our research laboratories, our staff is investigating methods to extend the hybrid fiber-coax structure, so as to leverage the ATM signal format and increase the raw bandwidth capabilities, through alternate cabling topologies.

All of this work is truly groundbreaking, in the sense that the penetration of such capabilities will have a profound impact on the daily lives of the men, women and children who ultimately use these networks in their daily lives. The breakthrough potential of the National Information Infrastructure will bring with it unprecedented rates of change and surprises that even a roomful of chief technical officers, like myself, cannot predict. Network solutions such as hybrid fiber-coax are enabling customer appliance manufacturers and network operators to safely utilize the network, which is the only laboratory large enough to run the needed service trials to determine these issues. With hybrid fiber-coax, we have developed a method of cost effectively bringing these new capabilities into the public's hands, so that they can experiment and educate us, the telecommunications industry, as to what they need and how they want to use the NII.

Thank you

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Mr. VALENTINE. Thank you, sir.

Mr. Ireland.

Mr. IRELAND. Good afternoon, Mr. Chairman.

My name is Ross Ireland, and I am the Vice President of Network Technology for Pacific Bell. I am responsible for the statewide evolution and transition engineering of Pacific Bell's switched and private line network.

I wish to thank you for the opportunity to appear before the Subcommittee today to discuss an issue which I believe is significant to my company, our industry and the American economy as a whole.

You have asked me to respond to four questions, and I will try to be brief and to the point as I respond from Pacific Telesis' point of view.

First, you have asked whether industry technology deployment plans are consistent with the Administration's vision of the NII, and, if not, what Federal actions would be necessary and appropriate to reconcile the inconsistencies.

We believe Pacific Bell's technology plans fit nicely into the Administration's vision of a communications network that makes vast amounts of information available to average Americans at affordable prices and in a way that provides social and economic benefit.

At Pacific Bell, we are applying our technological expertise towards building reliable, high-quality networks to create products and services that meet customers' needs and requirements. In harmony with the Administration's expectation of an NII offering interactive, broadband information services, the company is building a feature-rich, digital, advanced intelligent network which can be upgraded as customers' needs evolve.

In early 1993, Pacific Bell unveiled a $1 billion plan to replace all of its remaining switches with digital switches by the end of 1997. At the project's conclusion, digital switching will serve 100 percent of Pacific Bell's access lines, permitting widespread introduction of new services such as ISDN, advanced intelligent network capabilities and positioning the company for a broadband interface. At the same time, this new technology provides significant operational savings, allowing us to keep costs to end users low.

In November of 1993 we announced a $16 billion investment plan to upgrade our core network infrastructure over the next seven years and to begin building an integrated telecommunications information and entertainment network providing advanced voice, data and video services—our California first strategy. This investment represents a 25 to 30 percent increase over our normal capital budget.

On May 19th of this year, Pacific Bell officially began construction of the superhighway, with a focus on parts of the San Francisco Bay area, Los Angeles, Orange County and San Diego. When the construction effort is in full gear, Pacific Bell will be building at a pace of over 700,000 homes a year, 2,000 homes a day, or approximately one home every 40 seconds. More than 1.5 million homes will be hooked up by the end of 1996, more than 5 million homes by the end of the decade, and all of California by 2010.

So, we believe we're enabling the Administration's goal of making an advanced telecommunications system broadly available to Californians. And we're not just hooking up homes and businesses. We've also embarked upon a $100 million initiative to help California K through 12 schools, community colleges and libraries connect to this new information resource because we believe it can play an important part in education and lifelong learning.

In summary, Pacific Bell has made a significant investment commitment that will provide long-term benefits for education, jobs and quality of life in California. However, we are still hampered in doing all that we can do to promote the development of the NII.

State and Federal governments could enable faster progress by removing restrictions that prevent the Bell companies from providing long-distance service, manufacturing equipment, conducting R&D and providing video programming. Government should limit regulation to noncompetitive services and then regulate prices, not earnings. Government should support universal access by implementing new mechanisms that are consistent with a competitive market in order to achieve the goal of universal access to new communications and information services.

Moving on to the Subcommittee's second question, Pacific Bell believes openness is a key requirement for the NII, and that requirement must be uniformly applied to all operators. Open interfaces are needed at key points such as customer and network interfaces so that multiple service providers can easily connect to customers and a myriad of service provider networks can be effectively interconnected.

Openness does not imply or require a piece part unbundling of all facilities and services. That effort and cost could affect the goal of affordable access, delay deployment and even hamper effective competition.

A recent example highlights this point. Since 1988, Pacific Telesis has spent millions of dollars to create 35 unbundled services in response to the FCC ONA order. The total revenue to date from all of those services is less than $1,000. We think this sounds a warning: Regulatory requirements that result in capabilities and products nobody wants will discourage NII infrastructure investment.

Instead, we should focus on the goal of equitable and affordable access, selecting those few interfaces where connectivity and openness will be of value for interconnecting networks and provide the advantages of the NII to all users.

With respect to the Subcommittee's third question, we believe competition by its very nature causes companies to look for competitive advantage. Our industry has been fortunate that customers have demanded interoperability and connectivity as a service requirement. We must continue to support and accelerate the establishment of key standards needed to enhance this capability. This will be particularly true as we interconnect and interoperate data, video and other services.

As to the last question, what government R&D and standards development activities are necessary to achieve open access and interoperability in the NII that the private sector cannot or will not undertake on its own, we believe government can accelerate the NII with incentives for private industry. These incentives might include

tax credits, more favorable depreciation rates and financial assistance for related research.

Additionally, participation in public standards activities, industry forums and encouragement for rapid delivery of critical standards may be helpful. However, the government should not mandate standards. Most successful standards have been created by private industry groups that allow open participation, follow due process and rely on market acceptance to finally pick winners and losers.

In summary, I have emphasized three messages: We're investing in the NII vision but could do much more if restrictions directed at the industry as it existed in the 1960s and 1970s were removed.

Second, we should focus on standardizing key interfaces that allow openness and connectivity at reasonable cost.

And, third, the government should support standards where they are required and encourage R&D and private sector investment.

Mr. Chairman, I applaud the efforts and timeliness of this particular committee and wish to thank you for the opportunity to express my views at this time.

[The prepared statement of Mr. Ireland follows:]

Hearings on the
State of Development and Deployment
of Telecommunications Technology
in Support of the
National Information Infrastructure

United States House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Technology, Environment and Aviation

Rayburn House Office Building
Room 2318
Tuesday, July 26 at 1:30p

Testimony of Ross Ireland
Vice President - Network Technology
Pacific Bell
A Pacific Telesis Group Company

Mr. Chairman:

Good afternoon, my name is Ross Ireland, and I am the Vice President of Network Technology for Pacific Bell. I am responsible for statewide evolution and transition engineering of Pacific Bell's switched and private line network.

Thank you for the opportunity to appear before the Subcommittee today to discuss an issue which is significant to my corporation, to our industry, and to the American economy as a whole.

You have asked me to respond to four key questions, and I will try to be brief and to the point as I respond from a Pacific Telesis point of view.

First, you have asked whether industry technology deployment plans are consistent with the Administration's vision of the NII, and if not, what federal actions would be necessary and appropriate to reconcile the inconsistencies.

We believe Pacific Bell's technology plans fit nicely into the Administration's vision of a communications network that makes vast amounts of information available to average Americans at affordable prices and in a way that provides social and economic benefit. At Pacific Bell, we are applying our technological expertise towards building reliable, high-quality networks to create products and services that meet customers' needs and requirements. In harmony with the Administration's expectation of an NII offering interactive, broadband information services, the company is building a feature-rich, all-digital, advanced intelligent network, which can be upgraded as customers' needs evolve.

In early 1993, Pacific Bell unveiled a $1 billion plan to replace all of its remaining analog switches with digital switches by the end of 1997. At the project's conclusion, digital switches will serve 100% of Pacific Bell's access lines, permitting widespread introduction of new services such as ISDN and advanced intelligent network capabilities, and positioning the company for a broadband interface. At the same time, this new technology provides significant operational savings, allowing us to keep costs to end users low.

In November 1993, the company announced a $16 billion investment plan to upgrade its core network infrastructure over the next seven years and to begin building an integrated telecommunications information and entertainment network providing advanced voice, data, and video services -- our CALIFORNIA FIRST strategy. This investment represents 25 to 30 percent more than our normal capital budget.

On May 19 of this year, Pacific Bell officially began construction of the superhighway, with a focus on parts of the San Francisco Bay area, Los Angeles, Orange County and San Diego. When the construction effort is in full gear, Pacific Bell will be building at a pace of over 700,000 homes a year, almost 2,000 homes a day, or approximately one home every 40 seconds. More than 1.5 million homes will be hooked up by the end of 1996, more than 5 million homes by the end of the decade, and all of California by 2010.

So, we believe we're enabling the Administration's goal of making an advanced telecommunications system broadly available to Californians. And we're not just hooking up homes and business; we've also embarked upon a $100 million initiative to help California K-12 schools, community colleges and libraries connect to this new information resource because we

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believe it can play an important part in education and lifelong learning.

In summary, Pacific Bell has made a significant investment commitment that will provide long-term benefits in terms of education, jobs, and quality of life in California. However, we are still hampered in doing all that we can do to promote the development of the NII. State and federal governments could enable faster progress by removing the restrictions that prevent the Bell companies from providing long-distance service, manufacturing equipment, conducting R&D, and providing video programming. Government should limit regulation to non-competitive services and then regulate prices, not earnings. Government should support universal access by implementing new mechanisms that are consistent with a competitive market in order to achieve the goal of universal access to new communications and information services.

Moving on to the Subcommittee's second question, Pacific Bell believes openness is a key requirement for the NII, and that requirement must be uniformly applied to all operators. Open interfaces are needed at key points, e.g., at customer and network interfaces so that multiple service providers can easily connect to customers and a myriad of service provider networks can be effectively interconnected.

Openness does not imply or require a piecepart unbundling of all facilities and services. That effort and cost could affect the goal of affordable access, delay deployment, and even hamper effective competition.

A recent example highlights this point. Since 1988, Pacific Telesis has spent millions of dollars to create 35 unbundled services in response to the FCC ONA order. The total revenue to date

from all those services is less than $1,000. We think this sounds a warning: regulatory requirements that result in capabilities and products nobody wants will discourage NII infrastructure investment. Instead we should focus on the goal of "equitable and affordable access," selecting those few interfaces where connectivity and openness will be of value for interconnecting networks and provide the advantages of the NII to all users.

With respect to the Subcommittee's third question, we believe competition by its very nature causes companies to look for competitive advantage. Our industry is fortunate that customers have demanded interoperability and connectivity as a service requirement. We must continue to support and accelerate the establishment of key standards needed to enhance this capability. This will be particularly true as we interconnect and interoperate data, video, and other services.

As to the last question -- what government R&D and standards development activities are necessary to achieve open access and interoperability in the NII that the private sector cannot or will not undertake on its own -- we believe government can accelerate the NII with incentives for private industry. These incentives might include tax credits, more favorable depreciation rates, and financial assistance for related research.

Additionally, participation in public standards activities, industry forums, and encouragement for rapid delivery of critical standards may be helpful. However, the government should not mandate standards. Most successful standards have been created by private industry groups that allow open participation, follow due process, and rely on market acceptance to finally pick winners and losers.

In summary, I have emphasized three messages:

- we're investing in the NII vision, but could do much more if restrictions directed at the industry as it existed in the 1960's and 1970's were removed;

- we should focus on standardizing key interfaces that allow openness and connectivity, at reasonable cost; and

- the government should support standards where they are required, and encourage R&D and private sector investment.

Thank you for the opportunity to express these views.

Mr. VALENTINE. Thank you, sir.

Before I go on to other members of the panel, Mr. Personick and others, we've been joined by other Members, and I would like to give them an opportunity to make opening statements.

Ms. Morella, the distinguished lady from Maryland, do you have an opening statement?

Mrs. MORELLA. Thank you, Mr. Chairman.

I'm just going to ask unanimous consent that an opening statement be included in the record because I think this is a very important hearing as we begin to embark on this journey on the information superhighway. And I look forward to hearing the other people that we have who will testify on this behalf and hope that you will include my statement in the record.

Mr. VALENTINE. Without objection, so ordered.

[The prepared statement of Mrs. Morella follows:]

CONSTANCE A. MORELLA
TEA HEARING
RE: TECHNLOGY DEPLOYMENT AND INTEROPERABILITY
IN THE NATIONAL INFORMATION INFRASTRUCTURE
JULY 26, 1994

MR. CHAIRMAN, AS WE BEGIN TO EMBARK ON OUR JOURNEY ONTO THE INFORMATION SUPERHIGHWAY, IMAGES OF ELECTRONIC LIBRARIES AND MASSIVE DATABASES MADE AVAILABLE TO ALL AMERICANS AT THE TOUCH OF A BUTTON ARE BEING CONJURED. TODAY WE WILL INQUIRE ABOUT THE POSSIBILITY OF TRANSLATING THESE VISIONS INTO REALITY BY EXAMINING THE NATURE AND EXTENT OF PRIVATE SECTOR INVESTMENT IN DEPLOYMENT STRATEGIES FOR THE NATIONAL INFORMATION INFRASTRUCTURE (NII).

THE ADMINISTRATION HAS STRESSED THE IMPORTANCE OF ENSURING OPEN ACCESS TO

TECHNOLOGY AND INTEROPERABILITY OF DEVICES AND SOFTWARE IN ORDER TO ENSURE COMPETITION AND PROMOTE CONSUMER CHOICE. THIS WOULD ALLOW US TO MAXIMIZE THE SOCIAL AND ECONOMIC BENEFITS OF THE INFORMATION SUPERHIGHWAY.

I HOPE OUR WITNESSES WILL HELP US DETERMINE WHAT ROLE THE FEDERAL GOVERNMENT SHOULD PLAY IN THE DEVELOPMENT OF THE INFORMATION SUPERHIGHWAY IN ORDER TO ACHIEVE THESE GOALS OF OPEN ACCESS AND INTEROPERABILITY.

I ALSO LOOK FORWARD TO DETERMINING HOW THE FEDERAL GOVERNMENT MAY BE ABLE TO REFORMULATE CURRENT POLICIES TO STIMULATE AND SUPPLEMENT PRIVATE SECTOR INVESTMENTS IN THE NII AND TO LEARNING WHAT TYPES OF TECHNICAL

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STANDARDS AND RESEARCH AND DEVELOPMENT STANDARDS ARE NECESSARY TO ENSURE THAT THE NII LIVES UP TO ITS TRUE POTENTIAL.

THANK YOU, MR. CHAIRMAN. I LOOK FORWARD TO HEARING THE TESTIMONY OF OUR DISTINGUISHED WITNESSES.

Mr. VALENTINE. The gentleman from Indiana, Mr. Roemer.

Mr. ROEMER. Mr. Chairman, I do not have an opening statement.

Mr. VALENTINE. The gentleman from California, Mr. Rohrabacher.

Mr. ROHRABACHER. Mr. Chairman, I do not have an opening statement. Thank you.

Mr. VALENTINE. Thank you, sir.

Mr. Personick.

Mr. PERSONICK. Thank you, Mr. Chairman.

My name is Stewart Personick. I am an Assistant Vice President at Bellcore. Bellcore is owned by the seven Regional Companies formed at the divestiture of AT&T, and Bellcore is a research consortium. It does systems engineering, research and the development of software systems.

I'd like to summarize briefly the four points in my written testimony, and I hope to have a chance to elaborate later on.

The technologies that are going to be used and have been used to create the existing and the future NII are very rapidly depreciating technologies. And what I mean by that is not that they deteriorate physically or that they wear out. What I mean is that, over time, new technologies are constantly being created which are more cost effective or more powerful, and this phenomenon is easily observed by even the general public.

One need only look at the price of a cellular telephone today and compare that in price and performance to a cellular telephone just a few years ago as an example. The implication of this is that when one invests in creating the new NII one is faced with the fact that a competitor can sit on the sidelines and then come in later with a better or less expensive technology and compete. And this is a fact of life.

It's not an avoidable situation. But it creates a tension between openness in the NII and investment incentive.

And I don't come here with a proposal for how that balance should be made, but I believe it's very important for the committee to understand and take into account that unless the investments are depreciated very rapidly, which would imply very large—high prices to consumers because the investments would have to be recovered very quickly, if the investments are going to be recovered at the rates which lead to affordability, one has to be concerned as an investor with other competitors coming in later with a better and cheaper technology before one has recovered one's investment.

It's an economic issue. It's important, and it doesn't—I'm not implying the solution, just putting it on the table as an issue.

The second point I wanted to make is that the vision of the NII as an open, competitive environment is widely held, including by Bellcore and certainly by myself.

In order to create an open NII, certain technologies are required. For example, interoperability is an important requirement. In order to achieve interoperability or—by definition, interoperability involves making all the disparate services and products that would be supplied by multiple providers work together in a way that makes end-to-end applications work easily for end users. If things don't work, end users won't be able to use them.

The technology to create an open competitive NII all the way up to the applications—not just to connect networks together but all the way up to make applications work with each other and all the various service work together, that technology does not exist.

I was recently quite personally and heavily involved in a rather large symposium that was hosted at NIST on February 28th and March 1st. I have the proceedings of that symposium. Over 300 of the top scientists and research managers in the country were at this symposium, and a large number of technical challenges were identified, which have to be dealt with in order to realize, fully realize the vision of the NII.

I'm not saying that the technology doesn't exist to get started. There's lots of technology to get started, and that's why the NII is being created as we talk. But the technology to fully realize the vision of the NII does not exist.

And the question is, how will that technology be put in place? A great deal of that technology will be put in place by the efforts of the private sector, which is motivated primarily to invest its limited research investments into those investments that can produce competitive advantage. That's fine. Investing for competitive advantage is what our society encourages in a competitive marketplace.

But the question is, who will invest in those technologies that are required to achieve such things as interoperability, which really benefit the whole industry and ultimately benefit the people who have all these interoperable services available, but which do not produce a competitive advantage for any one firm? So what will incent individual firms in a very competitive marketplace to invest in those R&D investments which help the whole industry but which do not produce any competitive advantage for themselves?

And I believe that there are a number of mechanisms and techniques available to the government to promote investment in this type of so-called precompetitive R&D which helps the whole industry and ultimately benefits society. And I would like a chance to discuss those later if you wish to hear some further thoughts on that.

My third point with respect to the role of the Federal Government in standards is rather brief and I think consistent with what you've heard from others in the past. And that is that the role of the Federal Government should be to promote the emergence of those standards that are—that lead towards an open, competitive marketplace—and standards are important in that regard—to promote and protect the interests of the U.S. and U.S. industries in international standards activities and to certainly promote the special requirements of the government for unique applications such as defense where certain standards considerations need to be taken into account. And, in fact, the government does do that.

My final point in my testimony is that as the government does what it needs to do to create the technology and promote standards and to facilitate the emergence of the competitive marketplace the government should not place itself in competition with industry. And, more specifically, when the government conducts research or executes its missions in education, health care, et cetera, and when the government needs networking capabilities to support those mis-

sions, the government should endeavor to procure networking services from the competitive marketplace.

In those exceptional situations where the competitive marketplace cannot meet some very special need of the government and the government has to build or operate or subsidize its own networks, those specialized networks should only be used for the specialized purpose for which they were built, and excess capacity on those networks should not be sold by the government in competition with the private sector. This will only discourage private sector investment.

Thank you.

[The prepared statement of Mr. Personick follows:]

TESTIMONY

OF

STEWART D. PERSONICK
ASSISTANT VICE-PRESIDENT, INFORMATION
NETWORKING RESEARCH
BELLCORE

BEFORE THE SUBCOMMITTEE ON
TECHNOLOGY, ENVIRONMENT AND AVIATION

OF THE
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

JULY 26, 1994

TESTIMONY
OF
STEWART D. PERSONICK
ASSISTANT VICE-PRESIDENT, INFORMATION NETWORKING RESEARCH
BELLCORE

JULY 26, 1994

My name is Stewart D. Personick, Assistant Vice-President, Information Networking Research at Bell Communications Research, Inc., ("Bellcore"). In this position, I am responsible for research in the areas of science and engineering that underlie new applications of communication to allow individuals and groups to interact across geographical barriers, to allow individuals and groups to access stored information, and to allow computing resources to work cooperatively across a network in a distributed fashion.

These applications will allow individuals to communicate in multiple media: voice, full motion video, exchange of graphical materials, exchange of data, and will allow individuals to access information for education, medical, business, and leisure activities in an efficient manner available to all members of society.

These applications will allow valuable computing and information storage systems to be shared efficiently, and to be brought to bear collectively where their combined capabilities are needed. I am also responsible for the identification of the scientific and engineering barriers that might

stand in the way of the realization of these information networking capabilities, for research directed toward the removal of those barriers through invention, and for the demonstration of experimental research prototypes of information networks and applications that demonstrate the technical feasibility, usefulness, and usability of the applications.

I received a Bachelor's Degree in Electrical Engineering in 1967 from the City College of New York, supported by a New York State Regent's scholarship, and at no tuition charge. I received a Doctor of Science Degree from the Massachusetts Institute of Technology in 1970, supported by Bell Telephone Laboratories under their Graduate Studies Program and their Doctoral Support Plan. I have done research in telecommunications technologies and applications since 1970 at Bell Telephone Laboratories (1967-1978), TRW Inc. (1978-1983), and at Bellcore (1983-present). I have authored two books on the technology and applications of fiber optics in telecommunications, and have co-authored several other books. I have published over 50 articles and talks on advanced telecommunications technology and applications and have been granted 8 U.S. patents. I am a member of the U.S. National Academy of Engineering, a Fellow of the Institute of Electrical and Electronics Engineers, a Fellow of the Optical Society of America, and have served on several U.S. Government Panels and Committees, including the National Research Council Photonics Science and Technology Assessment Panel (1988). I am currently Chairperson-Elect of the Federal Networking Council Advisory Committee.

Bellcore is a telecommunications research and technology consortium owned by the seven Regional Companies formed in 1984 upon the divestiture of the former Bell System. Bellcore

serves as a central point of contact for National Security and Emergency Preparedness for the telecommunications affiliates of the seven Regional Companies. In addition Bellcore conducts extensive research, systems engineering, and software systems development for its owners/clients.

I am pleased to have the opportunity to testify this afternoon in regard to the state of development and deployment of communications technology in support of the National Information Infrastructure (NII). I will make four points:

1. There is an unavoidable tradeoff between open networks and investment incentive. There is general agreement that an open, competitive NII architecture and industry is the desirable long term objective. An open competitive environment is good for consumers of NII applications because it promotes the introduction of new services and applications, and it promotes lower prices. An open competitive environment is good for the industry because it promotes innovation and cost reduction, which in turn promote U.S. competitiveness. It also promotes reuse of deployed assets in new ways, which leads to increased revenue opportunities for those who have deployed NII assets.

There is, however, a tradeoff between an open architecture and investment incentive that exists during the initial deployment of the NII. There is a very rapid economic depreciation of NII investments because the technologies associated with the NII (computer and communication technologies) are continually and rapidly being improved and cost reduced. At the same time, because an advanced NII is in the process of being conceived and deployed, the market for NII applications and services is still developing. Those who make the initial investments in the

advanced NII face a combination of uncertainty as to which applications and services will experience good market acceptance, as well as a learning period during which the market for products and services will develop and mature. In the context of an open architecture, some competitors can wait on the sidelines while the pioneering competitors make substantial investments to enter and develop the market. Then these sideline competitors can pick and choose where to enter the market taking full advantage of the open architecture, and taking full advantage of the improved, cost reduced technologies that are then at their disposal. This creates a disincentive for pioneering investment, and those who choose to be pioneering investors will be reluctant to make their NII investments so open as to make it easy for competitors to enter later and destroy the value of their pioneering investments.

This tradeoff underscores an important tension between open architecture and investment incentive that exists during the initial deployment and development of an advanced NII. This issue needs to be closely examined to determine the correct balance between initial openness of the NII architecture and investment incentive.

2. The achievement of an open architecture, and the achievement of interoperability amongst applications, services, and technologies within an open architecture involves substantial technological challenges. For example, the core networks and services that support applications within the NII must be extremely reliable. Downtime is not consistent with many of the applications envisioned for the NII. Yet the technology to create an open architecture that is also provably resistant to accidental or intentionally induced outages does not exist at this time.

Similarly, the technology to achieve interoperability or to substantially mitigate the problems associated with achieving interoperability amongst applications, services and technologies also does not exist at this time[1]. Thus, much research and development remains to be done to create the technological capabilities needed to realize the objectives of open architecture and interoperability.

Since the benefits of this technology flow primarily to consumers of NII applications and services, and typically do not produce a proprietary advantage for any NII application or service provider (by definition, open architecture principles and interoperability technologies are only useful if they are widely adopted by all competitors), there is a natural role for government, as the representative of the interests of the public, in providing a substantial portion of the funding of the necessary R&D, and in taking a leadership role in assuring that the necessary R&D is carried out as a partnership of government, industry, and academia

3. The role of the federal government in standards should be as a promoter of standards, as an advocate of U.S. interests in international standards, and as an advocate of those standards issues that relate directly to government applications that are unique (i.e.,not the same as commercial applications) such as special defense related issues. The private sector is in the best position to create standards through voluntary activities such as those sponsored by the American National Standards Institute (ANSI).

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[1] "R&D for the NII": Proceedings of the Symposium on R&D for the NII held at NIST on February 28-March 1, 1994, available from EDUCOM.

4. The government should play a role jointly with industry and academia in the research and development of pre-competitive technology. However, the government must play this role carefully so it does not inhibit competition nor cause economic disincentives for the private sector to invest in the NII. Thus, with few exceptions, the government should not build, own, operate, or subsidize communications networks. An exception involves a situation where the private sector cannot meet the needs of the government. If the government does create or subsidize a network under this exception, there must be two restrictions. First, the network's use should be restricted to the agency mission purpose for creating the network. Second, the government may not sell services or excess capacity on the network in competition with the private sector. Violating this second restriction would a) create a major disincentive for the private sector to invest in the NII, and b) likely result in some customers migrating to the subsidized network, leaving fewer customers remaining on the private sector's networks among whom to spread the fixed costs of those networks, thus potentially raising prices to those remaining customers.

There have been positive trends by the government that can lead to increased competition and incentives for the private sector to invest in the NII. One encouraging trend in this direction is evidenced by the new NSFnet architecture, S.4 Title VI, and HR 1757. These initiatives in part involve the government shifting emphasis from the supply side to the demand side, i.e., the government will not spend money on standard networking technology, but rather shift support to deserving end-user communities for their access and use of capabilities provided by commercial network service providers. These initiatives also involve the government funding research into new technology, experimental test beds, and applications.

Thank you for this opportunity to testify this afternoon and I will be pleased to respond to any questions.

Mr. VALENTINE. Thank you, sir.

Mr. Bassermann.

Mr. BASSERMANN. Good afternoon and thank you, Mr. Chairman, for the opportunity to represent my company as well as the wireless industry here before you on the matter of the National Information Infrastructure.

I am here today in a dual role capacity. I spend most of my time as President of SNET Mobility, concerned about delivering quality cellular service at affordable prices to people in Connecticut and western Massachusetts.

Interestingly enough, I'm considered a medium-sized carrier within the context of the wireless industry, and it seems every week—when I pick up the paper, I feel smaller every week.

In addition, in Connecticut we have over 100,000 subscribers that we serve and have had much experience over the course of seven years in running a business—competitive business, I might add—in the wireless area.

I'm also here as Chairman of the Cellular Telecommunications Industry Association's Technology and Operations Council, where we deal with many of the issues of system interoperations in both the cellular industry and now the emerging wireless industry. And I have some comments that I'd like to make specifically regarding questions posed by the committee.

CTIA believes that the industry deployment plans not only are but must by necessity be consistent with the Administration's vision of the NII. It is a happy coincidence that the Administration's vision and that of our customers coincide exactly. It is this factor which compels the telecommunications industry to deploy technology in a manner totally consistent with the Administration's vision.

In the wireless industry today, the drivers pushing the service providers and, in turn, the manufacturers are very consistent with the Administration's vision of the NII. Open access to a wide range of services and applications available to a wide cross-section of the population at their choosing is exactly the objective of both the existing cellular and emerging wireless markets.

The most critical need for interoperability, connectivity and openness comes at the demarcation between the separate networks that collectively deliver the total spectrum of both wire line and wireless services. Separate networks can be developed to meet each of the specific needs of customers, but the combined total value comes from having those networks interconnected by standard interfaces that allow access of information across any network boundary.

The cellular industry has successfully dealt with this in the past via its IS-41 standard, which allows service providers to choose any vendor for the construction of their networks with the assurance that the vendor's equipment will communicate with neighboring and distant systems using equipment manufactured by a different vendor. These standards were developed by the entire industry, including the service providers, switch vendors and manufacturers of access devices.

That process will work in the future environment as well. As new wireless services emerge, such as PCS, they may simply choose to

build on the structure that is in place as a result of the efforts of the cellular industry over the last 10 years.

CTIA also believes that competition will encourage interoperable technologies. No telecommunications provider can build a system or a network that is an island unto itself. To do so we believe will ensure failure. As a result, every provider of telecommunications services must ensure that its chosen technology is interoperable with other communications networks, including the PSTN, the cellular industry and other future technologies.

It is this mandate that will ensure that the telecommunications industry will not develop noninteroperable technologies and networks. The FCC has already indicated that commercial mobile radio service providers must be provided access to the PSTN. As long as the access is in place, no other government intervention is necessary. As a result, Federal policy and programs need not be redirected to ensure open access and interoperability to the NII.

To support the position, one need look no further than the proven record of the U.S. wireless industry, which today links more than 17 million customers via a nationwide network of 1,500 cellular systems operated by 300 local and regional carriers. It is one of America's great success stories.

Without any government subsidies, cellular carriers have cumulatively invested more than $14 billion and created more than 40,000 new jobs since the first cellular system went on the air in 1984.

When related service and manufacturing activities are included, approximately 160,000 new jobs have been created by the cellular industry. Each day, more than 14,000 members become new subscribers, taking advantage of the safety, personal convenience, affordability and productivity that cellular phones provide.

And in countries around the world U.S. companies are successfully marketing wireless services and products. Last year, cellular telephones represented nearly $1 billion, or 10 percent of all U.S. telecommunications sports and about a third of the U.S. telecommunications trade surplus.

In my testimony, I indicate no government R&D and standards development activities are necessary to achieve open access and interoperability in the private sector. The industry must develop interoperability on its own to survive.

It is this enlightened self-interest that will provide the ultimate and most effective incentives to ensure interoperability will occur. Any efforts by the government to direct the choice of standards would be counterproductive and would detract from the attention of the industry in providing what customers need and want.

As for legislative action, Congress should at every opportunity ensure that all providers of comparable telecommunications services and networks are related—pardon me—regulated in the same manner. By ensuring that there are no artificial regulatory advantages or barriers to competition, the telecommunications industry will be spurred to develop the necessary services, features and interoperability that will satisfy the customer's needs and advance the policy visions of Congress and the Administration.

I believe that government through the FCC has acted in the consumer's best interest in the development of the cellular industry by

allowing market forces to shape the growth of the industry rather than a heavy regulatory policy. I urge Congress to continue this enlightened perspective as the wireless industry evolves.

I believe that wireless communications is emerging in a global context and that equipment manufacturers and service providers are driven by market needs that extend beyond America's shores. The same is true of offshore vendors. Thus, development of standards and interoperability characteristics are not influenced solely by domestic factors.

Finally, I believe that the same cooperation and entrepreneurial spirit that has served the American public well throughout the development of the cellular industry will be carried forward as the wireless industry expands. Traditionally, the value of service is in the breadth of the availability of communications and its ability to connect users. Nothing is different for a system without wires.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Bassermann follows:]

TECHNOLOGY DEPLOYMENT AND INTEROPERABILITY IN THE NATIONAL INFORMATION INFRASTRUCTURE

TESTIMONY OF PETER P. BASSERMANN
CHAIRMAN, TECHNOLOGY AND OPERATIONS COUNCIL
CELLULAR TELECOMMUNICATIONS INDUSTRY ASSOCIATION

BEFORE
THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY, ENVIRONMENT AND AVIATION

JULY 26, 1994

Mr. Chairman, Members of the Committee,

I am Peter P. Bassermann, President of SNET Mobility, Inc., a commercial mobile radio service provider based in New Haven and serving all of Connecticut and portions of Massachusetts. I am appearing before you today in my capacity as Chairman of the Technology and Operations Council of the Cellular Telecommunications Industry Association.

I would like to begin my testimony by observing the phenomenal success of the cellular industry and use that track record to underscore that an important factor in that success has been the approach taken by regulators. Without the "light" regulations espoused, this success would not have occurred. As the wireless industry expands in the future and includes new providers, market forces will continue to ensure the future development of features and services to meet market demand. Chief among these will be the interconnection among networks to allow access to the most broad base of the wireline and wireless networks as well as the information content available through that broad base.

Today there are over 300 cellular carriers operating in excess of 1,500 systems, all of which are truly "interoperable." In order for that to happen, the industry had to undertake certain efforts, including:

- **Development of a seamless and fully interoperable network for cellular systems**. This included the need to develop standards for the air interface to allow mobile units manufactured by any equipment provider to operate in a system

regardless of the type of underlying infrastructure equipment which was in place. This facilitated competition in the equipment (access device) market and includes not only the cellular handsets, but cellular modems and other access devices. The development of this interoperable network progressed as market demand gradually increased for more functionality to be carried across system boundaries. From the beginning of cellular service, the common air interface allowed customers to roam to other service areas beyond their home market. Soon after, a more comprehensive network interface standard was developed voluntarily by manufacturers and major service providers to allow for more features such as intersystem hand-offs. The industry worked jointly to add greater functionality to include fraud protection and enhanced customer features.

- **The development of standards to which all manufacturers must construct their equipment to facilitate interoperability among and between networks utilizing equipment manufactured by different vendors.** These standards, designated as IS-41 by the Telecommunications Industry Association (TIA), allow hand-off and call delivery among

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systems and allow networks to "talk" to each other to facilitate the seamless services.

- **The development of cellular clearinghouses to facilitate the exchange of information between cellular networks to support customers who roam beyond their home system.** These clearinghouses have been in place for years and are positioned to make their services available to new entrants into the wireless market in the future.
- **The development of backbone networks, which include a standard interface so that all cellular switches, regardless of the manufacturer, can communicate with one another.** These backbone networks allow carriers to interconnect to it and through it to each other to exchange information about their customers. There are four networks in place today -- AT&T, ITN, GTE and NACN. Through industry efforts, small carriers have been assured of having low cost access to these backbone networks. There is likely to be excess capacity which will be available for all other wireless providers once their networks are placed in service.

In addition to developing this seamless web of fully interoperable networks, which tracks the Administration's vision for NII, the cellular industry is continuing to work closely

with various emerging technologies that provide new and enhanced services. Technologies such as Cellular Digital Packet Data (CDPD), Digital Control Channel and Mobile Satellite Service (MSS) are being designed for full compatibility and interoperability with cellular. This is not just theoretical speculation. One mobile satellite company has already reached agreement with multiple cellular operators to service cellular customers who are out of range of any cellular system. This will be possible through the IS-41 platform, and the technology will be transparent to the end user. Each of these has required the development of open industry standards to which all manufacturers are allowed to construct their equipment so that these services can be provided on a seamless, interoperable basis

Standard Setting

I would like to remark next on the standard setting process itself, both as it applies to the cellular industry's past and as it will apply to the development of future standards and enhancements. The focus here should be on the fact that the industry developed those standards without the need for intervention of any government or regulatory body. Rather, the development of industry standards was a direct by-product of the enlightened self-interest of the manufacturers and the network providers.

One of the best examples of the responsiveness of the industry to the need for open standards is in the area of digital cellular equipment. Digital technologies are essential to increase capacity in the cellular systems and to provide even more clear and secure communications. This has necessitated that the industry carriers, switch vendors and access

device manufacturers all work together to develop a standard for interoperability among their devices.

Many of the members of the Committee may have heard that there is a debate between some cellular service providers which support Time Division Multiple Access (TDMA) and some which support an alternative technology called Code Division Multiple Access (CDMA). While this is true, it is a healthy debate, as it ensures that the system providers have a constant access to improving technologies. Just as government saw the need for more choices of service providers, there is also a need for system providers to have a choice of technologies. At the request of CTIA, the Telecommunications Industry Association (TIA), representing manufacturers, has now prepared and approved industry standards for both TDMA and CDMA digital technologies. Additionally, as the industry struggled with the standards for wireless data, a group of service providers and vendors grouped their efforts to form an early consensus to expedite the time to market. The result is an agreed protocol Digital Packet Data (CDPD) driven by the industry to reach the marketplace rapidly.

Market Forces

In the evolution of wireless technologies the competitive principal behind the management philosophies of the cellular industry has been an intense focus on the needs and interests of their customers.

What then do the customers want? They want to be able to place and receive calls (including voice and data) anywhere they are, at any time, without having to remember

special codes or make special entries to access a particular network. They do not want, and will not try, to keep track of the technology and access devices of the intended target for their calls and data transmissions. As a result, for the cellular carriers as an industry and for all telecommunications providers as a whole, to be competitive and to maximize profits, they must provide the customers with what they want. To do that, carriers must construct networks that are wholly interoperable in the sense that their customers will know when a call is placed from their network and device of choice, that call or data transmission will be received by the intended party. This must be true regardless of the network or access device chosen by the recipient. That is interoperability, that is the Administration's vision, and that is what must be implemented by all telecommunications providers for them to survive.

The cellular industry could not sell a service that was confined to a small geographic area or to a small number of customers who had chosen the same technology and devices. The telecommunications provider which offers that type of service will not survive. It's like the old saying, "In spite of the cost of living, it's still popular." The cost of living in the communications industry of today and tomorrow is to ensure that a provider's network can communicate with all other networks.

Interoperability

How will the providers ensure that this interoperability occurs? Through the development of industry standards, many of which will be evolutions from and derivations of standards already developed for the cellular industry. A cornerstone for these standards will and must be access to the Public Switched Telephone Network ,"PSTN". As long as any

other network provider has access to the PSTN, then calls can be placed and received from disparate networks and technologies with assurance that those calls can be delivered to any technology or network to which it is addressed.

In conclusion, I would like to briefly reiterate the points previously made in response to the specific questions posed by this Committee.

- **Are industry technology deployment plans consistent with the Administration's vision of the NII? If not, what federal actions are necessary and appropriate to reconcile such inconsistencies?**

  The industry deployment plans not only are, but must by necessity be consistent with the Administration's vision of the NII. It is a happy coincidence that the Administration's vision and that of our customers coincide exactly. It is this factor which compels the telecommunications industry to deploy technology in a manner totally consistent with the Administration's vision. In the wireless industry today, the drivers pushing the service providers, and in turn the manufacturers, are very consistent with the Administration's vision of the NII. Open access to a wide range of services and applications available to a wide cross section of the population at their choosing is exactly the objective of both the existing cellular and the emerging wireless markets.

- **In a less regulated environment, what R&D and technical standards are necessary to achieve an NII that offers openness, equitable and affordable access, interoperability, connectivity, and un-bundling of services and facilities?**

The most critical need for interoperability, connectivity, and openness comes at the demarcation between the separate networks that collectively deliver the total spectrum of wireline and wireless services. Separate networks can be developed to meet each of the specific needs of customers, but the combined total value comes from having those networks interconnected by standard interfaces that allow access of information across any network boundary. The cellular industry has successfully dealt with this in the past via its IS-41 standard which allows service providers to choose any vendor for the construction of their networks, with the assurance that that vendor's equipment will communicate with neighboring and distant systems using equipment manufactured by a different vendor. These standards were developed by the entire industry, including the service providers, switch vendors and manufacturers of access devices. That process will work in the future environment as well. As new wireless services emerge, such as PCS, they may simply choose to build on the structure that is in place as a result of the efforts of the cellular industry over the last ten years.

- **Will increased competition in the telecommunications industry lead to disparate, non-interoperable technologies that are contrary to achieving the Administration's goals for the NII? If so, how must federal policy and programs be redirected to ensure open access and interoperability in the NII?**

Competition will have just the opposite effect. No telecommunications provider can build a system or network that is an island unto itself. To do so is to ensure failure. As a result, every provider of telecommunications

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services must ensure that its chosen technology is interoperable with other communications networks, including the PSTN, the cellular industry and other future technologies. It is this mandate that will ensure that the telecommunications industry will not develop non-interoperable technologies and networks. The FCC has already mandated that commercial mobile radio service providers must be provided access to the PSTN. As long as the access is in place, no other government intervention is necessary. As a result, federal policy and programs need not be redirected to ensure open access and interoperability to the NII.

To support this position, one need look no further than the proven record of the U.S. wireless industry, which today links together more than 17 million customers via a nationwide network of 1,500 cellular systems operated by 300 local and regional carriers. It is one of America's great success stories. Without any government subsidies, cellular carriers have cumulatively invested more than $14 billion and created more than 40,000 new jobs since the first cellular system went on the air in 1984. When related service and manufacturing activities are included, approximately 160,000 new jobs have been created by the cellular industry. Each day, more than 14,000 Americans become new subscribers taking advantage of the safety, personal convenience., affordability and productivity that cellular phones provide. And in countries around the world, U.S. companies are successfully marketing wireless services and products. Last year, cellular telephones represented nearly $1 billion, or 10

percent of all U.S. telecommunications exports, and about a third of the U.S. telecommunications trade surplus.

- **What government R&D and standards development activities are necessary to achieve open access and interoperability in the NII that the private sector cannot or will not undertake on its own? What legislative action, if any, should Congress consider?**

As indicated, no government R&D and standards development activities are necessary to achieve open access and interoperability in the private sector. The industry must develop interoperability on its own to survive. It is this enlightened self-interest that will provide the ultimate and most effective incentives to ensure interoperability will occur. Any efforts by the government to direct the choice of standards would be counterproductive and would detract from the attention of the industry in providing what the customers need and want. As for legislative action, Congress should, at every opportunity, ensure that all providers of comparable telecommunications services and networks are regulated in the same manner. By ensuring that there are not artificial regulatory advantages or barriers to competition, the telecommunications industry will be spurred to develop the necessary services, features, and interoperability that will satisfy the customers' needs and advance the policy visions of Congress and the Administration.

This concludes my testimony Mr. Chairman. I'll be happy to respond to any questions.

Mr. VALENTINE. Thank you, sir.

Thank all of you.

Let me ask you at the beginning—I don't think we've always done this, but it seems to me that it might be a good idea. Do any of the witnesses wish to comment briefly on any of the testimony of the other witnesses?

All right. Sometimes that will get you into a fight, but I am sure that is not the case here. The Members of the Subcommittee will lead you to the fights.

How do we—gentlemen, let me ask this of all of you. The testimony we think has, of course, been very thoughtful and very comprehensive. How do we do all of the great things that have been suggested by these witnesses and others and how do we ensure—do all the things and just the government get out of the way and watch it happen, encourage it, deregulate?

How do we assure that the most affluent industrialized parts of the country are—receive the benefit and areas that are less fortunate? How are we going—how are we going to see to it that these advantages are made available to the weak as well as the strong, the needy as well as other groups?

Mr. Ryan?

Mr. RYAN. I think I can speak from a slightly different perspective from the rest of the people here, being the equipment supplier rather than network operator.

Our experience has been with working with customers throughout the United States that our offerings in the southern part of the United States and southwest are different than the California section, which is different than the East Coast. Our solutions have been optimized around the topologies and economics, and, in fact, we have won recently within the last few months a major award in a similar technology to bring rural telephony into China.

So through working with our customers who then, in turn, have customers who use the network, we have a family of variations around this technology which we have proven to be cost effective for both high and low density populations and also initial service demands of both high and low density.

Mr. VALENTINE. Before you others answer, let me just make a—draw your attention to the Congressional District that I represent, for example, which includes most of the developed part of the Research Triangle Park. It includes Duke University, includes very close proximity to the University of North Carolina at Chapel Hill, and an area that is entirely different from other parts of the district.

Parts of my district have a terrible illiteracy rate that approaches that in some Third World countries. And yet, you know, left to its own devices to where the money is, it's not in that part of the district. And unless we can find some kind of balance, some way to be sure that these advantages are available at the other end, too, you know, I mean that's just part of this cycle of poverty.

Mr. Ireland?

Mr. IRELAND. Mr. Chairman, I'm not sure I have the answer for how to ensure it per se, but I do want you to know that it is not something that is not of utmost importance to us in operating companies inside our respective regions.

In California, as an example, we are building in four areas, which I described in the formal testimony. We have looked at the demographics inside those four areas, and just to give you some comparative statistics, in the areas that we're going to build out the new information infrastructure, we have 23 percent Hispanic, based on a statewide average of 27; 14 percent Asian-American, based on a statewide average of 11 percent; 7.4 percent African-American, based on a statewide average of 7.8 percent.

We've also looked at the financials of the people who live in those areas. And the financials of people that are earning less than $25,000 are 21.5 percent there, based on a statewide average of 29 percent; and earning between 25 and 50,000, is 31 percent, based on a statewide average of 28 percent.

So it is something we look at, and we try to be able to basically build in those areas where the demographics do, in fact, generally match those of the entire State. It's not a perfect process, but it's one that we do test and look at as we build out the information infrastructure.

Additionally, our commitment is to bring this to all Californians, and so as we build out the network from these four core areas, our plan is to cover all people in the State.

Mr. VALENTINE. Mr. Personick—Doctor.

Mr. PERSONICK. Yes, Mr. Chairman, let me make three comments on that. I believe that part of the solution in providing the benefits of this technology to rural areas, which certainly doesn't include all of the poor, but rural areas, lies in wireless communication, because they—a big part of the cost of providing these applications to those areas is actually physically moving the information to where they are.

And I believe that one thing we can do as we—particularly when the government adjusts its own priorities for R&D, is to pay attention to the types of technologies that are particularly applicable to rural areas.

Let me also suggest that, with respect to these technologies, being rich or poor may not have the traditional meaning. That is, the ability to use this technology may be as much of a factor in access as the ability to afford this technology. And so to achieve the vision of the NII, to achieve universal access, one not only has to have affordability, which is traditionally what comes to mind, and ubiquity, which means wherever you are you can access it, but also usability.

And one of the most difficult challenges we face is, from a technical perspective, is to create the breakthroughs in usability that will make this technology accessible to everyone. And I think that particularly may be important to people who are not yet literate. Because these multimedia—the multimedia versions of these applications are particularly helpful to people who are trying to access information who, for example, can't read or at least initially can't read.

And let me just end by saying that if I look back to when I was growing up in New York—and I think by any measure I was reasonably qualified to be called poor—purchasing a TV set, for example, even a black and white set, was a major investment and something to be given a great deal of thought and care. Perhaps equiva-

lent for a black and white TV, if I adjust for inflation, to $2,000 today.

And, as you know, you can buy a large color television with a remote control, et cetera, for $350. If you're careful, maybe even less. You can buy a black and white TV for less than a hundred dollars new and probably get a used one for $10 that will also last for 10 years. Whereas the $2,000 black and white television my father bought required a $50 service call, adjusting for inflation, about every month to replace a tube or something like that.

So I think that one of the keys to making this technology ubiquitously available to all is to continue to promote the tremendous progress that technology has afforded us in low-cost manufacturing and improvement in performance.

Mr. VALENTINE. Yes. I don't know. Maybe by the questions we can get into this with—by other experts, not other experts, but experts like Mr. Rohrabacher asking the questions.

But I think that maybe part of what I'm talking about is while you, maybe your family, the black and white television set might have been a great luxury, I dare say that the school that you attended had access to all the equipment that was necessary to teach you and others. And that's sort of the kind of thing I'm talking about, the variance in different parts of many Congressional Districts as to what can be afforded at that level. But we will see.

Mr. Bassermann.

Mr. BASSERMANN. Let me start with a comment about America in its rural context. Americans today have access to cellular service at better than 90 percent of the geography of this country. So cellular service is available in over 90 percent of the geography.

And I might add, if memory serves me right, that the rural markets that came up after the larger cities came on board more quickly than the urban areas. So there was certainly the commitment on the industry to make sure that when those markets were open that we, with haste, developed that area, because there are very definite needs for rural subscribers.

In my own operation, we certainly have consumers as the largest part of the growing wireless segment in large measure because, as commented here, the price of the equipment itself has gone down dramatically. And service plans are also being tailored across the country for different needs.

Certainly, the consumer has a different need in what they're willing to pay on a monthly basis for service as opposed to the large corporate executive or, for that matter, the medium-sized business. So service plans are being tailored for cheaper and cheaper monthly access for wireless service to make it more affordable for the consumer at large.

In the area of the education aspect that you raise, I think there's a role for wireless to play there as well in the education of our youth as well as adults. Many of the schools in this country where learning takes place are very old, in excess of 40 years of age. And to retool the communications infrastructure in that school to provide for enhanced learning both for teachers as well as students is expensive, given the nature of the asbestos that we find in many of those schools.

Wireless communications can offer a great opportunity to equip the classrooms for education without the need for tearing down walls and the high labor costs associated with removing asbestos.

Here I think the government can be helpful in providing incentives or stimulation to enhance the overall speed at which we reequip our education system for improved learning, both in the area of achieving better literacy as well as many of the goals of the Department of Education in terms of the competitiveness of our students.

Mr. VALENTINE. Mr. Rohrabacher.

Mr. ROHRABACHER. I seem to be getting a message that most of you on the panel think that the private sector is doing very well in the development of this information highway and this new system. That's my—is that right? Pretty much?

What I want to know is not necessarily what the government can do, which is what you're answering, but what should we worry about the government doing in getting in the way of the private sector which might be able to get the job done on its own? What do you fear most from the government in terms of what it might do to mess things up?

Just whoever wants to answer that.

Mr. BASSERMANN. Let me take the ball and run with it a little bit. I think what would impede progress would be if the regulatory aspects are dealt with on a State-by-State basis. I think it is important in the overall development of the wireless industry and, for that matter, the information superhighway that this be dealt with, if you will, as best at the Federal level and that we not have different jurisdictions on a State-by-State basis developing their own rules for what is required to move the information superhighway forward.

And I happen to be only a two-jurisdiction operation, but many people in the industry have multiple jurisdictions, and the different rules of the roads on a State-by-State basis I think would frustrate the ability to get some of the things done in a timely fashion.

Mr. ROHRABACHER. Anyone else have a suggestion there?

Mr.T4Ireland. Perhaps on a similar note, I think the speed with which regulation is able to act so that we can, in fact, move on being able to build those pieces of the NII, where it is possible to build today, where technology exists today, is an important factor. And to the degree that the regulatory environment moves slowly, it hampers our ability to be able to also move. And we've had several examples of that. So I think that's an area that I think is most important.

Additionally, I think overregulation in some areas where we may be asked to do more things than are necessary to build the NII will cause us to put energies into areas such as the ONA example that I cited which aren't necessarily conducive to the building of the infrastructure that I believe we all want.

Mr. ROHRABACHER. Can you give me another couple examples of that?

Mr. IRELAND. Well, on December 20th of 1993, we put forward a 214 filing to be able to offer video services in the area where we're going to place the new NII infrastructure. We have not had a response yet from that particular regulatory request.

Additionally, in California regulation, we have seen ourselves offer to customers contracts for new and creative services and yet we find that there are so many interveners working on that particular contract process that we're unable to get the contracts out of the Commission to be able to offer the service.

Mr. ROHRABACHER. Excuse me. Could you—intervener, could you tell me what you mean by that?

Mr. IRELAND. Sure, other service providers. We wind up having other service providers debate at the Commission why we should not be offering certain types of service under contract to end-user customers, ones that they would, in fact, compete for, that particular service and that particular capability.

The long delay in being able to get those approved at the Commission causes customers to lose faith in us as service providers and, therefore, causes us not to have incentive to work hard for new and creative solutions to customers. We want to do that. We simply want to be able to get answers to whether we can or not in a timely way.

Mr. ROHRABACHER. Are there technical requirements that might be placed on by the government—have a deleterious effect? Could you give me some examples of that in terms of, for example, mandating certain technologies as you were talking about how the technologies are changing?

Mr. IRELAND. I think it's difficult to say specifically what might occur. But, clearly, if a technology were mandated that was particularly difficult to deliver or one that has not matured to a level where it may be robust and one that we feel good about deploying in the network—

Mr. ROHRABACHER. Is there not an example of that? Does anyone here have an example of that?

Mr. PERSONICK. For example, when you open up an interface, you create the possibility of either intentional or unintended harm. Let me give you an illustration.

An existing interface which isn't a problem at the moment is your existing telephone connection. You could go home, pick up your telephone, make a lot of calls. You wouldn't cause any harm to anybody. You'd run up a big bill, perhaps you wouldn't be able to pay it, but, other than that, you know, what's the big deal?

But when you open up powerful interfaces and the vision of the NII, these powerful distributed computing environments—this is a technical discussion, but nobody knows how to build those things in an open way so that you have all the power available to use and know in advance what can go wrong.

And we are—I don't want to throw stones at anyone because everyone has these problems, okay, so this is not one person against another. But some of the problems we see in major exchanges going down, like the unfortunate problem about a week ago at NASDAQ, illustrate the difficulty of building these large distributed computing environments that have to do very complex tasks and anticipating everything that can go wrong.

Surely these people didn't intend for that to happen. They tried very hard to avoid it. Nevertheless, their worst nightmare came true.

So an example would be a mandate to open things up in the spirit of competition, before the technology exists to do that in a safe way. And this is a trade-off that's come up before.

Mr. BASSERMANN. I guess I think we have an example in the wireless industry where if, for instance, we had solidified around only one technology, let's say the first generation of digital technology for cellular, we would not have seen the entrepreneurialism come forth and bring CDMA to the table. And, for that matter, who knows what four and five years down the road may bring?

And it's interesting with technology today that generally there are lower costs and greater benefits associated with the newer technology. I believe that technology is continuing in a dynamic fashion with very short windows of opportunity.

And there are clearly choices for carriers on which technology to adopt, but I think principal with the capitalistic society that we're in, choices are what's important, not only for consumers but also for providers of service as well. And I think it's difficult to solidify around one technology because we all do not have perfect foresight.

Mr. ROHRABACHER. Is there any problem in terms of—some people when they deal with the government feel that the regulators and the people who get involved from the government are anti-profit. Is there any problem with the government's attitude towards profit? Is that inhibiting this development?

Mr. BASSERMANN. What is the government's attitude toward profit?

Mr. ROHRABACHER. Well, people have—in other industries have suggested to me that, basically, if you make too much profit you're considered to be actually—from a private sector point of view, if you make a lot of profit you're satisfying a lot of customers. But from the government perspective, quite often, if you make a lot of profit you're a bad guy.

And someone was telling me we're going to have an information highway when we make sure that people can get rich off making sure that there's an information highway and services provided to the public. And I'm not sure where the government is standing on this whole idea of making a profit off this whole operation. If that makes any sense. Maybe it doesn't.

Mr. BASSERMANN. Certainly, I think as we sit here in the communications industry, we find ourselves all in the common carrier situation. And we have an ombudsman that has worked well over the years in making sure that there's the appropriate discipline in place and that we serve the public interest, as is our obligation, and that we provide fair and reasonable costs for services. And that seems to—

Mr. ROHRABACHER. I sat next to a gentleman who ran a gas and oil pipeline. And, apparently, now his gas and oil pipelines that are across the country are obsolete. And what he did was use something that was, I guess, for cleaning the pipeline. He used that technology to string fiber cable through his pipeline to various cities. And you probably know who I'm referring to.

But it seems to me that if we had government—excessive government involvement in the fiber-optics revolution, that this gentleman probably would have been left out. And the government itself would have suggested that they were going to dig new holes,

and you'd have the government cable system which everybody would have to plug into.

And, quite often, it just seems to me that in order to make sure that everybody is under control and to make sure that people aren't profiting from things, that the government gets involved and it costs people more in the long run. It's just an observation.

And, with that, Mr. Chairman—

Mr. VALENTINE. Well, that Mr. Rohrabacher might have slipped over too far. Sometimes he tends to fall off to the right. They sure have worried the hell out of AT&T over the years—and others.

Mr. ROHRABACHER. Thank you, Mr. Chairman, thank you.

Mr. VALENTINE. The gentleman from Pennsylvania, Mr. McHale.

Mr. MCHALE. Thank you, Mr. Chairman.

I was delayed by another commitment in arriving in the hearing room and did not hear the direct testimony of the witnesses and would not wish to question them under circumstances where obviously I've not had the benefit of their prior testimony. So I simply thank them for their testimony and appreciate the opportunity to question, but, for the time being, I'll reserve my questioning for a later point.

Mr. VALENTINE. Thank you, sir.

The gentleman from California and I have a running, semi-friendly feud. If you can't think of situations that would fit what he's talking about, I invite you to supply them to the Committee after you might think of some things on the way back home. I know in my other life when I would argue before the North Carolina Supreme Court, I always made my best speech in the car going home, so you think of things like that.

Mr. Ryan, in layman's terms, why are most local telephone companies purchasing AT&T's multimedia network technology?

Mr. RYAN. I think, very simply put, it is a—it's made up of some very, very sound and proven technologies, so that the risk of installation in millions of people's backyards, as Mr. Ireland referred to earlier, is low. We have a large amount of installation support experience, so that our ability to deliver and operate in an effective way the network is high.

And the system has a cost-effective opportunity to allow us to carry traditional telephony and multimedia services at a much more efficient operations cost, a cost per year to keep the network running, than even the traditional copper plan. So without a lot of new revenue assumptions it is a very attractive financial package. And it does enable the stimulation of new revenue, which makes it even more attractive.

Mr. VALENTINE. The Administration describes its version or their version of NII as a, quote, digital broadband interactive multimedia network, close quote, where anybody can communicate with anybody else, anywhere, anytime, anyplace, in any form. Will the AT&T technology that most telephone companies seem to be purchasing, in your judgment, provide that type of capability?

Mr. RYAN. Yes, it provides the ability to offer that service, although it is based on some older technologies.

We talked about coax and cable TV. For the interactive services, it is end-to-end digital. It terminates in all the switching and video server equipment which is in development now and, in reality, is

open-ended to the point of allowing us to develop tens of megabits of capacity to individuals' homes for switched service, which outstrips all the current and projected services we know of now in the multimedia revolution.

Mr. VALENTINE. Mr. Ireland, what are the factors that led Pacific Telesis to select AT&T technology for deployment in California?

Mr. IRELAND. Well, Mr. Clark mentioned at least two of those. One was, clearly, the cost. It's an alternative that looks cost effective to us, and we always examine that as one of the key criteria.

Additionally, as he's talked, the operational savings are actually quite dramatic using this technology, so we believe that the cost of maintaining and operating this network is going to be dramatically lower cost than maintaining and operating the copper network, which allows us to keep the cost of introducing this service very low to end users and subscribers. We think that's critically important.

There was another factor that wasn't mentioned that I think is important and that is that this is a technology that allows end users to use the technology immediately without necessarily buying upgraded technology for their home. To the degree that they would like to utilize existing video services, existing telephony services, the inside wire that they have in their home is usable for the service, the coaxial cable inside their home is usable for the service, and no new or different appliance is required.

However, at such time as they wish to take advantage of new and expanded services that might be available on this network, such as digital video and multimedia services, those appliances can be purchased as they wish to expand their capability in using the service.

We felt that was a fairly strong advantage. Competing technologies that we looked at required the end user to buy new appliances in their home or have new appliances in their home that was required to do digital decoding, if, in fact, they purchased a technology different from this hybrid fiber-coax using the analog pass band technology. So we think that was a major opportunity for the end user.

Finally, the technology looks upgradable. That is, over time, you can actually take the fiber closer to the customer's home and increase the band width as you do that.

And so, with all of those together, it looked like a very effective technological choice for us.

Mr. VALENTINE. Mr. Bassermann mentioned the possibility, I wouldn't say the threat, but the possible handicap of State-to-State involvement in this process, which is—one can easily understand. This is, I guess, an invitation to answer further Mr. Rohrabacher's problem or question. What is it that you fear, if that's the way to put it, from the Federal Government as we start on this new adventure?

Mr. IRELAND. I guess other than the ones that I have talked about so far, which are really the opening too early of new technologies, I have thought of one example of that where I do have some nervousness. But the opening of new technologies too early or the forced introduction of a technology too early is probably the greatest fear that I have right now.

One of the most recent NPRMs that I have read has been associated with the opening up of the SS-7 signaling network. And in the opening up of that network, the early recommendations for how to open it up, although challenging, looked technically doable.

Those things that are discussed in opening the network over time, which is opening it in real time, opening it where the actual calls are in progress to third-party providers and potentially having more people involved in the control of any one call or any one data service, looks very risky to me. I don't know how to build a distributed network that allows a variety of people to be in control of it.

If you have a distributed architecture, one entity needs to be in control of that particular distributed intelligence. And I am very concerned that orders to open up the network that would cause other parties to have distributed control of the network will make it very difficult for me to basically guarantee service provision.[1]

Those other providers could, in fact, order calls to be routed to equipment that doesn't exist. They could call for routines to be executed that I do not have. And assuring that all possible protections are in place to protect against those eventualities looks very difficult and very challenging.

So it's in those kinds of areas that I guess I have my greatest concerns.

Mr. VALENTINE. What services and benefits will the new network provide to businesses and individuals in California?

Mr. IRELAND. Most of what's being provided is in higher-speed services. So the kinds of capabilities that people would be able to have with this network are ones that today are not possible at relatively low speeds but are enabled by much higher speeds. So being able to have images transmitted, being able to have video service transmitted, is now a capability that is very possible even to the home with the kinds of technologies that we're talking about here.

So the possibilities of remote medicine, at-the-home remote monitoring of the infirm at the home, are all things that are possible with this technology. Work at home is possible with this technology, and even work at home where the end user requires a very high-end workstation are now possible with this kind of technology.

Additionally, if you think of video learning and remote learning, that, too, is possible at not only remote locations but also in the home using this kind of technology.

So if you kind of let your imagination wander you can see what you might be able to do with any number of video services or any number of image-based services using the higher speed that this has made possible.

Mr. VALENTINE. Dr. Personick, what's the outlook for Bellcore after the end of this year when the legal requirement that the local telephone companies fund Bellcore expires?

Mr. PERSONICK. Yes, Mr. Chairman, let me correct what I believe may be a misunderstanding. There is not, nor has there ever been, any legal requirement for any of Bellcore's seven shareholders or its other customers to fund any work at Bellcore. The only exception to that that I'm aware of is the mandated support for national

[1]The witness has requested the word "provision" be changed to "performance"

security and emergency preparedness, which is a very, very tiny fraction, much less than 1 percent of our total funding.

Mr. VALENTINE. So is that what expires at the end of this year?

Mr. PERSONICK. Nothing, to my knowledge, expires at the end of this year. This is not the case.

Mr. VALENTINE. Well, what's the outlook for Bellcore?

Mr. PERSONICK. There are a variety of options being considered by Bellcore's board. This is not unusual because everyone in this industry, including all the providers of services or would-be providers, are constantly considering their options at this time. And you read about those in the paper every day.

Nothing has been decided with respect to how Bellcore will evolve in the future, so it's difficult for me to characterize any outlook for Bellcore except that, to the best of my knowledge, no option that is being considered will diminish Bellcore's technical capability.

Mr. VALENTINE. Can you tell us what options are being considered?

Mr. PERSONICK. I can describe these. It is simply an objective description that has been given to our approximately 7,000 employees. So, in that sense, it's no secret.

These are—again, I must caution you, these are simply options that are being considered. One option is to make no change whatsoever in the current structure of Bellcore as a privately held firm with seven shareholders, namely the seven regional companies. Another option is to substantially increase the Bellcore customer base.

Our own board has, for good business reasons, continually reevaluated who Bellcore's customers should be. When we first started out, our only customers were the seven Regional Companies and then, over time, that's been extended to others. So, at this point in time, about 10 percent of our revenues comes from other customers, and that's growing fairly rapidly.

Another option that's been considered is to expand or modify Bellcore's ownership so that Bellcore could conceivably—and this is just hypothetical—issue additional shares of stock or reissue some of the existing stock. So these—

Another possibility amongst all of those is a divestiture, where the—a secondary offering would be made and Bellcore's existing shareholders would sell their stock perhaps as an initial public offering. I know that people have rumored as to one or the other of these actually happening, and I want to reemphasize that, just as you and your wife might consider moving to a new house or buying a new car, it doesn't mean you're going to do it. The fact that we're considering these options doesn't imply that any one of them is going to happen.

Mr. VALENTINE. Okay. Well, I was going to make some cute response to that, but I won't.

Mr. Bassermann, your testimony—what is the current state of commercial development and deployment of the digital cellular technology?

Mr. BASSERMANN. There are two—there are two kinds of digital cellular technology today, either in service or in trial. Let me deal with what's in service.

The CDMA digital cellular service, which was established some years ago as a standard, is, in fact, in commercial operation in a number of markets around the country. Continued evaluations take place regarding that digital cellular standard to improve the quality of service associated with that standard, and there continue to be developments along that line. The CDMA technology is in trial in the Northwest, and we expect commercial deployment of the initial CDMA systems in about 12 months.

Mr. VALENTINE. Mr. Inslee, do you have any—

Mr. INSLEE. I have no questions.

Mr. VALENTINE. The gentleman from Washington, do you have any questions?

Mr. INSLEE. No, thank you.

Mr. VALENTINE. Mr. Rohrabacher.

Mr. ROHRABACHER. This new digital cellular system, will that—from what I understand, that will provide the potential of even more miniaturization of communication. Is that right?

Mr. BASSERMANN. That's correct. It uses a different protocol, and thus we get some increased efficiencies and scale factors.

Mr. ROHRABACHER. Tell me, do you ever foresee the Dick Tracy watches actually coming into reality?

Mr. BASSERMANN. The easy answer is yes. The tough one is when. If you look at the factor associated, however, with communication, I haven't figured out a way to move the ear and the mouth closer together. And so in some respect, I think you are constrained by anatomy more than anything else.

Mr. ROHRABACHER. All right. Thank you very much, Mr. Chairman.

Mr. VALENTINE. Thank you.

I have a matter on the Floor mine that I've got to attend to, a bill of Chairman Brown and I would like to again thank you for myself and all Members of the Subcommittee and ask you if you would please, within reason, respond to questions that might be sent to you from Members of the Subcommittee within the next few days.

And with that, I will say again thank you very much and have a safe journey home. And the Subcommittee stands adjourned.

[Whereupon, at 2:53 p.m., the Subcommittee was adjourned.

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